

ABSTRACT

5 A coolant system for a cryoablation or treatment probe such as a mapping or ablation catheter, or a treatment wand, includes a compressor and condenser having a low pressure inlet side and a high pressure outlet side, wherein the outlet side passes through a heat exchanger and is cooled by the inlet side and conditioned for injection to a catheter inlet. A vacuum return system connectable to the catheter outlet draws thermally expended coolant from the catheter and returns it to the low pressure inlet side. A motorized pressure regulator between the heat exchanger and the catheter inlet determines the pressure of coolant passing into the catheter and thus regulates the cooling rate for a selected mapping or ablation regimen. The low pressure compressor inlet supply preferentially conditions the pressurized coolant to ambient temperature or lower before injection into the catheter, allowing the coolant to travel through the body at ambient before expansion in the tip. In a preferred embodiment, a coolant reservoir feeds into the low pressure inlet side and receives a return flow of excess fluid from a branch off the outlet side of the compressor. The vacuum return assures that coolant does not leak into the blood stream, and preferably various check valves and bypass valves operate in the event of pressure buildup to return fluid to either the inlet or supply from different points along the loop. The coolant mixture preferably has a boiling point of approximately -60° Fahrenheit at about 1-2 bar, and may be compressed to several hundred psi. The entire system is amenable to microprocessor control for providing ablation cooling cycles to operate the catheter tip in accordance with a selected protocol, and for effecting system functions such as recharging and venting of the supply, and shutting down during nonuse or upon occurrence of a fault condition.